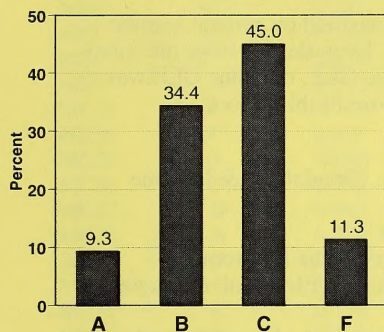


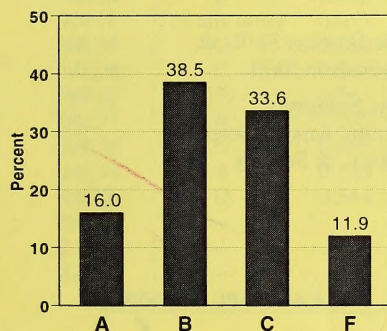
Science 30

Diploma Examination Results Examiners' Report for June 1999

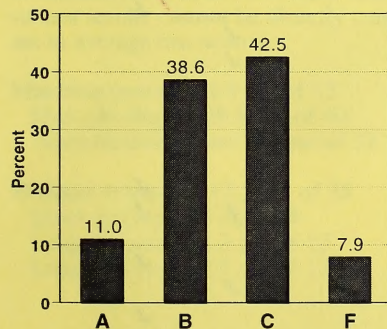
School-Awarded Mark



Diploma Examination Mark



Final Course Mark



The summary information in this report provides teachers, school administrators, and students with an overview of results from the June 1999 administration of the Science 30 Diploma Examination. This information is most helpful when used in conjunction with the detailed school and jurisdiction reports that are provided electronically to schools and school jurisdiction offices. A provincial report containing a detailed analysis of the combined January, June, and August results is made available annually.

Description of the Examination

The Science 30 Diploma Examination consists of 40 multiple-choice questions worth 50%, 12 numerical-response questions worth 15%, one short answer question worth 5%, and two long answer questions worth 30% of the total examination mark.

Achievement of Standards

The information reported is based on the final course marks achieved by 1 244 students in Alberta who wrote the June 1999 examination and received a school-awarded mark.

- 92.1% of the 1 244 students achieved the *acceptable standard* (a final course mark of 50% or higher).
- 11.0% of the 1 244 students achieved the *standard of excellence* (a final course mark of 80% or higher).

Students demonstrated a good understanding of the principles of genetics. Science 30 students continued to improve their communication skills. Their answers were generally well-organized, and all parts of the written-response questions were addressed. Responses could have been improved by greater use of specific examples to support ideas.

Approximately 47.1% of students who wrote the June 1999 examination were female. Of these, about 87.5% achieved the *acceptable standard* on the examination, compared with 88.6% of the male students. Approximately 15.7% of the female students achieved the *standard of excellence*, compared with 16.3% of the male students. The average examination mark achieved by the female students was 65.4%, and male students achieved an average mark of 66.0%.

Provincial Averages

- The average school-awarded mark was 62.7%.
- The average diploma examination mark was 65.7%.
- The average final course mark, representing an equal weighting of the school-awarded mark and the diploma examination mark, was 64.6%.

Results and Examiners' Comments

This examination has a balance of question types and difficulties. It is designed so that students achieving the *acceptable standard* will obtain a mark of 50% or higher, and students achieving the *standard of excellence* will obtain a mark of 80% or higher.

In the following blueprint, diploma examination questions are classified by question type: multiple choice (MC), numerical response (NR), short answer (SA), and long answer (LA). The column labelled "Key" indicates the correct response for multiple-choice and numerical-response questions. For numerical-response questions, a limited range of answers was accepted as being equivalent to the correct response. For multiple-choice and numerical-response questions, the "Difficulty" indicates the proportion (out of 1) of students answering the question correctly. For short and long answer questions, the "Difficulty" is the mean score (out of 1) achieved by students who wrote the examination.

Questions are also classified by general learner expectations (GLE). Even though some questions address more than one GLE, only one GLE was selected for the purpose of this report.

Knowledge:

- GLE 1 Nervous, Circulatory, & Immune Systems
- GLE 2 Genetics
- GLE 3 Chemistry & the Environment
- GLE 4 Gravitational, Electrical, & Magnetic Fields
- GLE 5 Astronomy & the Electromagnetic Spectrum
- GLE 6 The Production & Use of Energy

Skills:

- SPC Scientific Process Skills & Communication Skills

Science, Technology, Society:

- STS Connections Among Science, Technology, & Society

Blueprint

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPC	STS
MC1	B	0.965		✓						✓
NR1	2134	0.713	✓						✓	
MC2	D	0.430	✓							
NR2	4123 or 1234	0.405		✓					✓	
MC3	C	0.838	✓							✓
MC4	B	0.705	✓						✓	
MC5	B	0.566			✓				✓	
MC6	B	0.850	✓							
MC7	D	0.926	✓							
MC8	B	0.750	✓							
MC9	A	0.807	✓							
MC10	D	0.677	✓							✓
NR3	7.97 to 7.99	0.665				✓			✓	✓
MC11	A	0.746	✓							
MC12	D	0.748			✓					✓
NR4	7.52 or 7.53	0.424			✓				✓	
MC13	D	0.547			✓					✓
MC14	B	0.628						✓		✓
MC15	C	0.838		✓						✓
MC16	D	0.405		✓					✓	

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPC	STS
MC17	D	0.780			✓				✓	✓
MC18	D	0.749			✓				✓	✓
MC19	C	0.764			✓					✓
NR5	1432	0.483						✓		✓
MC20	A	0.695				✓				
MC21	D	0.760			✓				✓	
MC22	D	0.681				✓			✓	
NR6	86.2	0.782				✓			✓	
NR7	12.5	0.720				✓			✓	✓
NR8	1.92	0.568				✓			✓	✓
NR9	2.65 or 2.66	0.312						✓	✓	✓
MC23	C	0.711		✓					✓	
MC24	C	0.620		✓					✓	
MC25	A	0.810		✓						
MC26	C	0.731						✓		✓
MC27	D	0.963						✓		✓
MC28	A	0.888						✓		✓
MC29	A	0.768						✓		✓
MC30	C	0.682						✓		✓
MC31	C	0.775						✓		
MC32	B	0.327						✓		
MC33	C	0.707						✓	✓	
NR10	1.35	0.495						✓	✓	
MC34	B	0.642				✓				✓
NR11	124 any order	0.655					✓			✓
MC35	C	0.710						✓		✓
MC36	C	0.563					✓			
NR12	132	0.563						✓	✓	
MC37	B	0.786				✓			✓	✓
MC38	D	0.495					✓			
MC39	B	0.535	✓							✓
MC40	D	0.544	✓							
SA	—								✓(4)	
LA1	—								✓(12)	
LA2	—									✓(12)

Subtest: Machine Scored and Written Response (Average by Subtest)

When analyzing detailed results, bear in mind that subtest results **cannot** be directly compared. Results are in average raw scores.

Machine scored: 34.9 out of 52
Multiple-choice: 28.1 out of 40
Numerical-response: 6.8 out of 12

Written response: 17.5 out of 28
Short Answer: 2.5 out of 4
Long Answer 1: 7.3 out of 12
Long Answer 2: 7.5 out of 12

Raw Score Averages for Machine-Scored Items and Written-Response Questions by General Learner Expectation

GLE 1	Nervous, Circulatory, & Immune Systems	8.5	out of	12
GLE 2	Genetics	4.8	out of	7
GLE 3	Chemistry & the Environment	5.3	out of	8
GLE 4	Gravitational, Electrical & Magnetic Fields	5.5	out of	8
GLE 5	Astronomy & the Electromagnetic Spectrum	1.7	out of	3
GLE 6	The Production & Use of Energy	9.0	out of	14
SPC	Scientific Process Skills & Communication Skills	22.9	out of	37
STS	Connections Among Science, Technology, & Society	25.2	out of	37

Multiple-Choice and Numerical-Response Questions

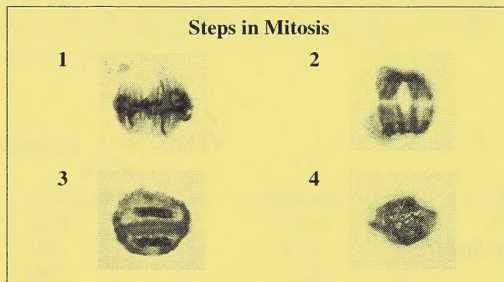
The following table gives results for seven questions selected from the examination and shows the percentage of students in four groups that answered each question correctly. The comments following the table relate to some of the understandings and skills the students may have used to answer these questions.

Percentage of Students Correctly Answering Selected Machine-Scored Questions

Student Group	Question Number						
	NR2	MC16	MC23	MC24	MC25	MC30	MC31
All Students	40.5	40.5	71.1	62.0	81.0	68.2	77.5
Students achieving the <i>standard of excellence</i> (80% or higher, or A) on the whole examination	61.8	63.3	87.4	86.9	91.5	88.9	93.5
Students achieving the <i>acceptable standard</i> but not the <i>standard of excellence</i> on the whole examination	39.9	38.1	70.8	60.2	81.2	66.8	78.0
Students who have not achieved the <i>acceptable standard</i> (49% or less, or F) on the whole examination	15.5	24.3	50.7	39.2	66.2	48.6	52.7

Numerical-response question 2 and multiple-choice questions 16, 23, 24, and 25 provide an indication of students' knowledge and understanding of genetics principles.

Use the following information to answer the next question.



Numerical-response question 2 assessed students' ability to recognize the stages of cell division. While it is not necessary that students memorize the names of the stages, they should be able to follow the progress of cell division by recognizing the position of the chromosomes. Photographs were used rather than diagrams in order to assess lab skills. Of all students, 40.5% responded correctly.

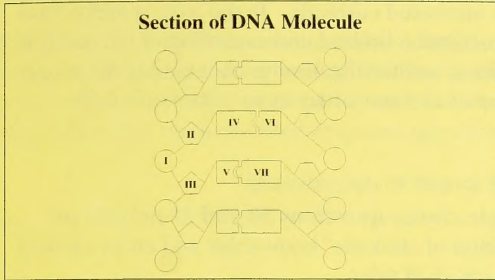
Numerical Response

2. The sequence in which these mitotic steps occur is ____, ____, ____, and ____.

(Record your **four-digit answer** in the numerical-response section on the answer sheet.)

Answer: 4123 or 1234

Use the following information to answer the next question.



16. In the diagram above, structures that represent the base pairs responsible for the coding of gene sequences are
- A. I and II
 - B. II and III
 - C. II and IV
 - *D. V and VII

Use the following information to answer the next 2 questions.

The scientists observed that within a certain school of fish, there was a 3:1 ratio of blue fish to white fish. A number of factors could be responsible for this.

- I Both parents are homozygous for colour
- II Both parents are heterozygous for colour
- III Blue colour is dominant over white
- IV White colour is dominant over blue

23. Assuming that all the fish are from the same pair of parents, the factors that could account for this ratio of blue fish to white fish are
- A. I and III
 - B. I and IV
 - *C. II and III
 - D. II and IV
24. If a heterozygous male is crossed with a homozygous white female, what is the predicted proportion of their offspring?
- A. 0% blue, 100% white
 - B. 25% blue, 75% white
 - *C. 50% blue, 50% white
 - D. 75% blue, 25% white

Question 16 assessed students' knowledge of the structure and function of DNA. On this question, only 40.5% answered correctly. The 45.4% of students who selected response B demonstrated that they did not recognize that the matching shapes of the base pairs are responsible for DNA coding. These results indicate that students experience more difficulty with molecular genetics than they do with Mendelian genetics.

Question 23 was answered correctly by 71.1% of the students. Of the students writing, 26.4% chose A. It could be inferred that by answering A or C, 97.5% of the students demonstrated that they realized that the blue allele must be dominant.

Question 24 is a straightforward single-trait Mendelian cross. Of the students writing, 62.0% chose the correct answer. Students at the *standard of excellence* have few problems with this type of question.

25. In reproduction, fish **produce eggs and sperm (gametes)**. A **sperm fuses with an egg** and the resulting zygote undergoes **multiple cell divisions**. The order of the processes described above is

*A. meiosis, fertilization, mitosis
B. mitosis, meiosis, fertilization
C. meiosis, disjunction, segregation
D. segregation, mutation, disjunction

Use the following information to answer the next question.

Statements Relating to Tides

- I Low and high tides occur three times a day.
II Gravitational potential energy is changed to kinetic energy.
III The gravitational force of the Sun has less effect on tides than does the gravitational force of the Moon.
IV The gravitational force of the Sun has a greater effect on tides than does the gravitational force of the Moon.
V The gravitational forces of both the Sun and the Moon act together to cause spring tides.

30. Correct statements about tides are

A. I, II, and IV
B. I, III, and V
*C. II, III, and V
D. III, IV, and V

-
31. Which of the following statements explains the formation of tides?

A. Earth rotates faster than the water in the oceans and the water's inertia causes it to move around the planet. This causes tides.
B. The Sun's uneven heating of Earth's surface and oceans causes wind and ocean currents. Combinations of these currents cause tides.
*C. The gravity of the Moon and Sun pull on the water of the oceans and cause it to bulge. This, combined with the rotation of Earth, causes tides.
D. Magnetic and gravitational fields affect the water in the oceans, causing it to move in a large cycle synchronized with magma movement beneath Earth. This causes tides.

Students had little difficulty with **question 25**: 81.0% answered correctly. In the past, students have demonstrated a limited understanding of the function of meiosis and fertilization in maintaining the proper number of chromosomes in an organism's cells.

Multiple-choice **questions 30 and 31** provide an indication of students' knowledge and understanding of the cause of tides.

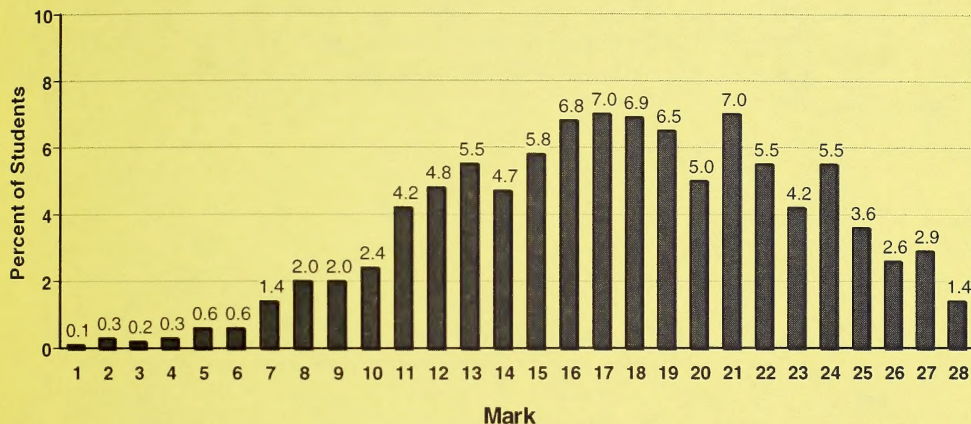
On **question 30**, 68.2% of the students responded correctly. Students generally seemed to understand the causes of tides, but by answering A or B, 27.4% of them indicated that they thought tides occur three times a day. This would indicate that some students have a limited understanding of the relative motion of the Sun, Moon, and Earth.

Question 31 was answered correctly by 77.5% of the students. Most students seemed to realize that gravity and Earth's rotation are the causes of tides.

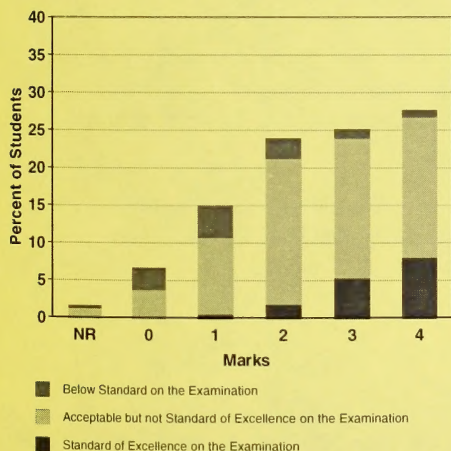
Written-Response Questions

Performance on written-response questions continues to improve. Many students are now using specific examples from science and technology in their responses. All students answered at least one of the three written-response questions, 75.3% received 14 marks or more, and 20.2% received 23 marks or more out of 28. The average percentage on the written-response questions was 62.6%.

Distribution of Marks for Written Response

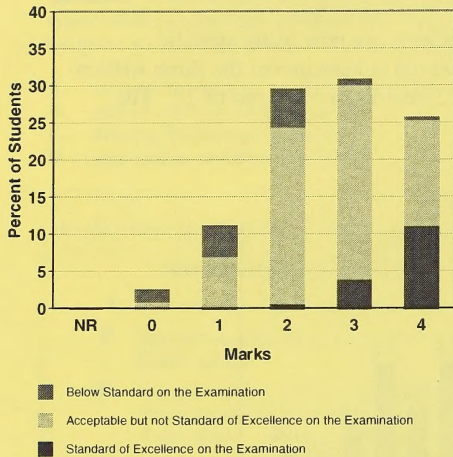


Distribution of Marks for Short-Answer Question 1



The **short-answer question** required students to draw lines of refraction through a block of glass and through a convex lens. The students who achieved the *acceptable standard* usually indicated that the light bent upon entry into the glass. The students who achieved the *standard of excellence* were able to show the light refracting accurately both entering and exiting the glass. On this question, 76.8% of the students achieved the *acceptable standard* and 27.7% achieved the *standard of excellence*. The average percentage for this question was 62.3%. It was evident from the responses that many students are participating in lab work where they explore the effect of lenses on light.

Distribution of Marks for Long-Answer Question 1

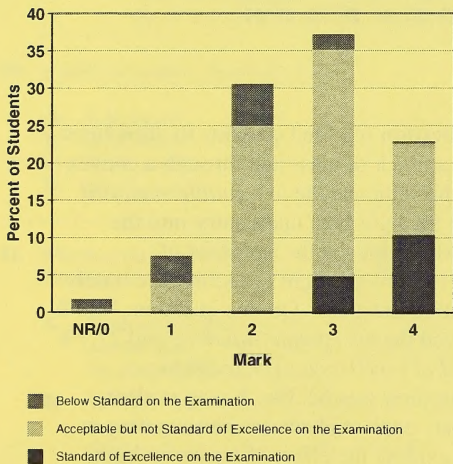


Long-answer question 1 required the students to evaluate the design of a study and suggest methods for improvement.

Most students identified the change in food as a weakness in the design of the experiment. Students who achieved the *standard of excellence* recognized that controls were necessary. They were able to identify a number of factors that may have led to inaccurate results.

On this question, the average was 60.7%, with 75.1% of the students achieving the *acceptable standard* and 25.7% achieving the *standard of excellence*.

Distribution of Marks for Long-Answer Question 2



Long-answer question 2 required the students to explain the points of view of two authors concerning the treatment of the environment. They were also asked to outline their own position on this topic.

Most of the students were able to summarize the differences in the points-of-view presented in the question.

Students who achieved the *standard of excellence* could give examples that supported opposing points of view and could outline a reasonable position about maintaining the environment.

On this question, the average was 62.8%, with 81.0% of the students achieving the *acceptable standard* and 22.9% achieving the *standard of excellence*.

For further information, contact John Drader jdrader@edc.gov.ab.ca or Corinne McCabe cmccabe@edc.gov.ab.ca at the Student Evaluation Branch at (780) 427-0010. To call toll-free from outside of Edmonton, dial 310-0000.

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